WHAT IS CLAIMED IS:

1. A method for detecting a fault on a transmission line by using harmonics and a state transition diagram, the method comprising the steps of:

i) generating an entry confirmation signal and a critical confirmation signal, in which the entry confirmation signal, which is a signal for notifying whether or not a path of apparent impedance enters into a zone, is outputted from a transmission line by utilizing voltage and current of an electric power system and a sum of harmonics components of the transmission line is calculated so as to output the critical confirmation signal, which is a signal for notifying whether or not the sum of harmonics components exceeds a predetermined critical value;

ii) applying the entry confirmation signal and the critical confirmation signal to a state transition diagram in order to make a state transition depending on variation of the entry confirmation signal and the critical confirmation signal; and

iii) presuming a state of the electric power system by analyzing the state transition in the state transition diagram according to variation of the entry confirmation signal and the critical confirmation signal, thereby determining a fault, no-fault state, and a load-interruption state, in which apparent

impedance enters into the zone due to an increase of load.

2. The method as claimed in claim 1, wherein the critical confirmation signal is calculated according to following equations:

$$H_{sum} = \sum_{k=2}^{N/2} |X(k)|$$

$$X(n) = \sum_{k=0}^{N-1} x_k W_N^{nk} = \sum_{k=0}^{N-1} x_k \cos(\frac{2\pi nk}{N}) - j \sum_{k=0}^{N-1} x_k \sin(\frac{2\pi nk}{N}) \qquad (n = 0,1,2, \ldots ,N-1)$$

wherein, $W_N=e^{-j(2\pi/N)}$, $x_k=x[t-(N-1)+k]$, $X(n)$ is harmonics component, and H_{sum} is a sum of harmonics components.

3. The method as claimed in claim 1, wherein step ii) includes the substeps of:

a) shifting into a load-interruption state when apparent impedance enters into a third zone as load increases in relation to an input of the entry confirmation signal and the critical confirmation signal in an initial state, and shifting into a fault proceeding state when the sum of harmonics components exceeds the critical value;

b) maintaining a present state if the entry confirmation

signal and the critical confirmation signal are not varied after the state has been shifted into the fault proceeding state, shifting into the initial state if apparent impedance is out of the third zone or the sum of harmonics components becomes lower than the critical value due to a decrease of load, and shifting into a fault state when the sum of harmonics components exceeds the critical value and apparent impedance enters into the third zone due to increase of load;

c) shifting into a circuit breaker trip state for tripping a circuit breaker if a predetermined time is delayed after the state has been shifted into the fault state, maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied, shifting into the initial state if apparent impedance is out of the third zone due to the decrease of load, and shifting into a fault removing state if the sum of harmonics components exceeds the critical value when load has been increased; and

d) maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied after the state has been shifted into the fault removing state, and shifting into the fault state if apparent impedance enters into the third zone and the sum of harmonics components becomes lower than the critical value.

4. The method as claimed in claim 3, further comprising

the substeps of:

e) maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied, shifting into the initial state if apparent impedance is out of the third zone due to the decrease of load, and shifting into a primary load-break and fault state when apparent impedance enters into the third zone due to the increase of load and the sum of harmonics components exceeds the critical value;

f) maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied after the state has been shifted into the primary load-break or fault state, shifting into the initial state when apparent impedance is out of the third zone due to the decrease of load and the sum of harmonics components becomes lower than the critical value, and selectively shifting into a load-break proceeding state or a secondary load-break or fault state when load is creased; and

g) shifting into the fault state due to a time delay after the state has been shifted into the secondary load-break or fault state, maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied, and shifting into a load-break proceeding state if apparent impedance is out of the third zone due to the decrease of load and the sum of the harmonics components exceeds the critical value.

5. The method as claimed in claim 4, further comprising the substeps of maintaining the present state if the entry confirmation signal and the critical confirmation signal are not varied, shifting into the initial state if apparent impedance is out of the third zone due to the decrease of load and the sum of the harmonics components becomes lower than the critical value, and shifting into the fault proceeding state when increased load is continuously maintained.

6. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the fault proceeding state, the fault state, and the circuit break trip state, it is determined that the circuit breaker is tripped under a condition that apparent impedance enters into the third zone of a distance relay while causing the fault and the fault is not removed due to a time delay.

7. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the fault proceeding state, the fault state, the fault removing state,

the initial state, or in a course of the initial state, the fault proceeding state, the fault state, and the initial state, it is determined that the fault is removed by means of a main protection under a condition that apparent impedance enters into the third zone of a distance relay, thereby occurring the fault.

8. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the load-interruption state, and the initial state, it is determined that apparent impedance entered into the third zone of the distance relay while increasing load is out of the third zone of the distance relay so that load is decreased.

9. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the load-interruption state, the primary load-break or fault state, the secondary load-break or fault state, and the initial state, it is determined that load is shut off after the fault occurs in a state that apparent impedance enters into the third zone of the distance relay.

10. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the load-interruption state, the primary load-break or fault state, the secondary load-break or fault state, the fault state, and the circuit break trip state, it is determined that the circuit breaker is tripped under a condition that apparent impedance enters into the third zone of a distance relay while increasing load and causing the fault and the fault is not removed due to a time delay.

11. The method as claimed in claim 5, wherein, in step iii), when a state transition procedure according to the entry confirmation signal and the critical confirmation signal is carried out in a course of the initial state, the fault proceeding state, and the initial state, it is determined that the load is shut off when the fault occurs.